ABSTRACT - Optimizing Compressor Performance with High Precision Actuation and Tuning

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Introduction: Compressor trains are amongst most critical equipment in any type of processing plant, increasing the velocity and pressure of a gas to increase the energy available in the process. The efficiency of a compressor is determined by comparing the energy input to the energy output. Precise control of compressors is vital to the optimization of the plant process, and reliability and availability of these compressors is critical to overall plant profitability.

Objective: The key to success for optimal compressor train performance is in modernizing the controls platform to increase reliability and uptime, which delivers greater throughput, and enhances precision to eliminate waste. The purpose of this presentation, will focus on the return provided through upgrade of the critical actuation involved in compressor process loops, from drivers such as steam turbines or gas turbines, compressor inlet guide vanes, or auxiliary valves such as recycle valves or blow-off valves. Typical compressor train actuation requirements include: high repeatability, unlimited duty cycle, fast stroking speeds, fail safe capability, and minimal dead time, in a package that can withstand high ambient temperatures. Depending upon the application, you will typically see hydraulic or pneumatic actuation utilized for control. Both types of technologies have advantages and disadvantages, which we will examine in detail.

Project: We will review a case study, where a U.S. chemical plant was experiencing large swings (200-400rpm) in speed control of the main air blower. Unreliable actuation combined with poor system tuning made the plant unable to maintain the set point target, which caused trip scenarios which resulted in process downtime, costing the plant tens of thousands of dollars per hour of availability lost. Beyond the impact of downtime, even when the compressor train was operating, the plant was unable to use the high-end applications of the controller for load sharing, and for automatic start-up sequencing. The compressor efficiency was degraded because operations now needed to be controlled in manual. This plant instituted a project to eliminate the existing hydraulic system and upgrade to a self-contained electro-hydraulic actuator and tuned the train for optimal performance.

Results:
Upgrading the actuation provided immediate benefits for the facility. The system was now retuned for improved speed control, allowing the turbomachinery train to match its performance with the desired process set point more accurately and reliably. The plant recognized an immediate maintenance reduction through the removal of the existing control oil and piping, thus eliminating the hassle of oil maintenance and filtration requirements associated with this system. The automatic startup sequencing and load sharing features of the control system could now be utilized, improving the overall process control stability of the unit, and increasing the capacity for the entire system by greater than fifteen percent. The facility was even able to reduce insurance rates by de-rating the risk of fire through the removal of existing control oil supply at the turbine deck.